Materials Science, Vol. 45, No. 4, 2009

APPLICATION OF THE MODELS OF MECHANICS FOR THE EVALUATION OF THE MICROSTRUCTURAL PARAMETERS OF ALLOYS WITH ELEVATED WEAR RESISTANCE

O. A. Kuzin,[1] **R. A. Yatsyuk,**[1] **and M. O. Kuzin**[2]

UDC 539.3

We show the possibility of application of the approaches of mechanics to the determination of the relative fractions and sizes of phases in antifriction alloys with elevated wear resistance. It is demonstrated that the wear resistance of B16 babbitt increases if its microstructure contains an Sn Sb hardening phase whose size is equal to 53 μm .

Keywords: binary heterogeneous systems, structure, models of structure, mechanical properties, tribomechanics, stress–strain state, wear resistance.

The existing methods used for the evaluation of the parameters of serviceability of metallic systems are based on the models and approaches of mechanics [1–5]. In what follows, we use these approaches for the determination of the structural parameters of binary heterogeneous metallic systems with elevated wear resistance.

Note that binary antifriction alloys containing soft and hard components are extensively used in manufacturing friction units for the railway transport. The reliability and service life of these units depend both on their internal structure and on the operating conditions. If the external loads are set, then the structure of the material plays the role of an important factor specifying the service life of the product [6–12].

The problem of determination of the optimal structural parameters according to the criterion of wear resistance of binary heterogeneous metallic systems is reduced to the following two problems: (i) the problem of finding the optimal relative fractions of the components and (ii) the problem of determination of their sizes. The algorithm of construction of the solution and the results of determination of the optimal relative fractions of the components of binary heterogeneous metallic systems can be found in [13].

The optimal sizes of the structural components for which the wear resistance of binary antifriction alloys increases are determined for B16 babbitt used in the production of inserts for plain bearings. The technology of their production by the method of centrifugal casting, the chemical composition of the alloy, its specific structural features, and the investigations of wear resistance are described in detail in [7].

Due to the absence of data on the mechanical characteristics of the structural components of babbitt (Sn Sb and eutectic phases) in the literature, numerous investigations were carried out for the evaluation of these characteristics according to the data of measuring microhardness (H_V) [10]. For this purpose, we used a PMT-3 microhardness tester. To find the optimal loads, we plot the dependences of microhardness on the level of static loading $H_V(P)$ (Fig. 1a). These results were applied to select a working load of 0.50 N corresponding to the transition of the curves $H_V(P)$ to a horizontal plateau, i.e., the microhardness is almost independent of temperature.

[1] "L'vivs'ka Politekhnika" National University, Lviv, Ukraine.

[2] Pidstryhach Institute for Applied Problems IN Mechanics and Mathematics, Ukrainian National Academy of Sciences, Lviv, Ukraine; e-mail: n_kuzin@mail.ru (corresponding author).

Translated from Fizyko-Khimichna Mekhanika Materialiv, Vol. 45, No. 4, pp. 105–109, July–August, 2009. Original article submitted September 9, 2008.

